US010186729B2

(12) United States Patent
Haag et al.

(10) Patent No.: US 10,186,729 B2
(45) Date of Patent: Jan. 22, 2019

(54) **BATTERY CELL COMPRESSION METHOD AND ASSEMBLY**

(71) Applicant: **Ford Global Technologies, LLC**, Dearborn, MI (US)

(72) Inventors: **Jeffrey Matthew Haag**, Dearborn, MI (US); **Eid Farha**, Ypsilanti, MI (US)

(73) Assignee: **Ford Global Technologies, LLC**, Dearborn, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 112 days.

(21) Appl. No.: **15/462,006**

(22) Filed: **Mar. 17, 2017**

(65) **Prior Publication Data**

US 2018/0269518 A1 Sep. 20, 2018

(51) **Int. Cl.**

H01M 2/02 (2006.01)
H01M 2/10 (2006.01)
H01M 10/04 (2006.01)

(52) **U.S. Cl.**

CPC ***H01M 10/0481*** (2013.01); ***H01M 2/0262*** (2013.01); ***H01M 2/0267*** (2013.01); ***H01M 2/1077*** (2013.01); *H01M 2220/20* (2013.01)

(58) **Field of Classification Search**

CPC H01M 10/0481; H01M 2/0267; H01M 2/1077; H01M 2/0262

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2014/0045037 A1*	2/2014	Nishikawa	H01M 2/0267	429/156
2014/0141338 A1*	5/2014	Kim	H01M 10/0431	429/246
2015/0037662 A1*	2/2015	Pinon	H01M 2/0237	429/179
2015/0147638 A1*	5/2015	Tamura	H01M 2/0277	429/179
2015/0188198 A1*	7/2015	Bonhomme	H01M 10/48	429/61
2015/0243938 A1*	8/2015	Kim	H01M 2/0217	429/185
2015/0318570 A1*	11/2015	Choi	H01M 10/0565	429/144
2015/0349302 A1	12/2015	Baek et al.		
2016/0126583 A1*	5/2016	Kato	H01M 10/049	429/185
2016/0190531 A1	6/2016	Neuberger et al.		
2016/0285061 A1*	9/2016	Reinshagen	H01M 2/1077	

FOREIGN PATENT DOCUMENTS

DE	102013217903	3/2015
DE	102014204737	9/2015
DE	102014219644	3/2016

OTHER PUBLICATIONS

Robopac, Vertical Stretch Wrapping Machine, Robopac USA, retrieved from http://www.robopac.com/US/Products/Vertical_stretch_wrapping_machines on Jan. 13, 2017.

* cited by examiner

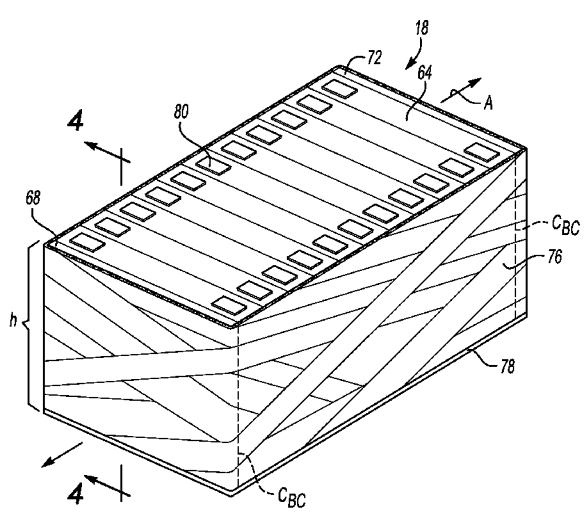
Primary Examiner — Stewart A Fraser

(74) *Attorney, Agent, or Firm* — Carlson, Gaskey & Olds, P.C.

(57) **ABSTRACT**

An exemplary method includes, among other things, winding a curable material at least partially about a plurality of battery cells that are compressed by a fixture. An exemplary assembly includes, among other things, a plurality of battery cells compressed by a fixture, and a curable material wound around the plurality of battery cells.

20 Claims, 6 Drawing Sheets



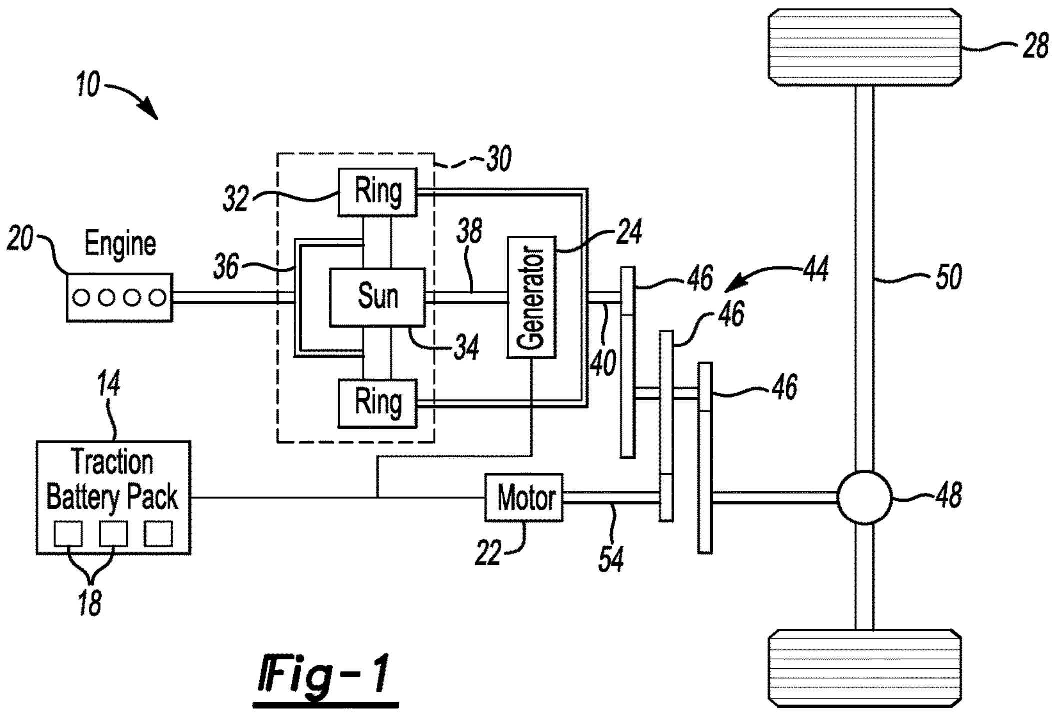

10
28
30
32
Ring
38
24
20
Engine
36
Sun
Generator
46
44
50
46
34
40
14
Ring
46
Traction
Battery Pack
Motor
48
22
54
18

Fig-1

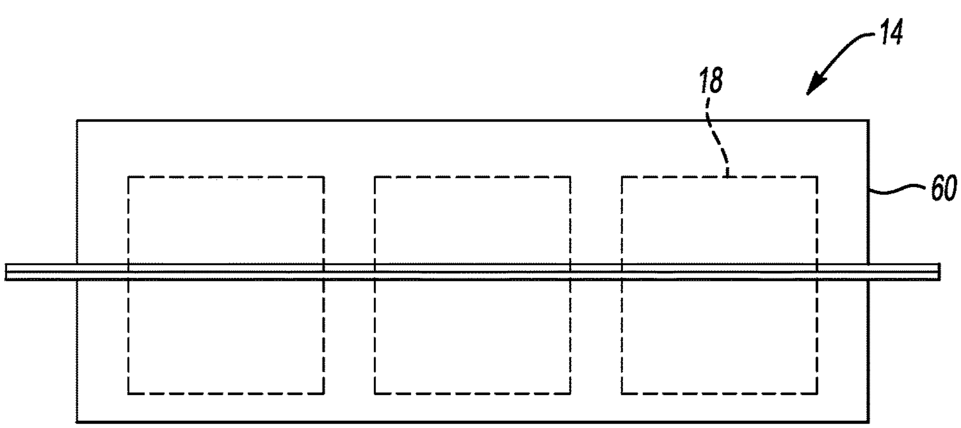

14
18
60

Fig-2

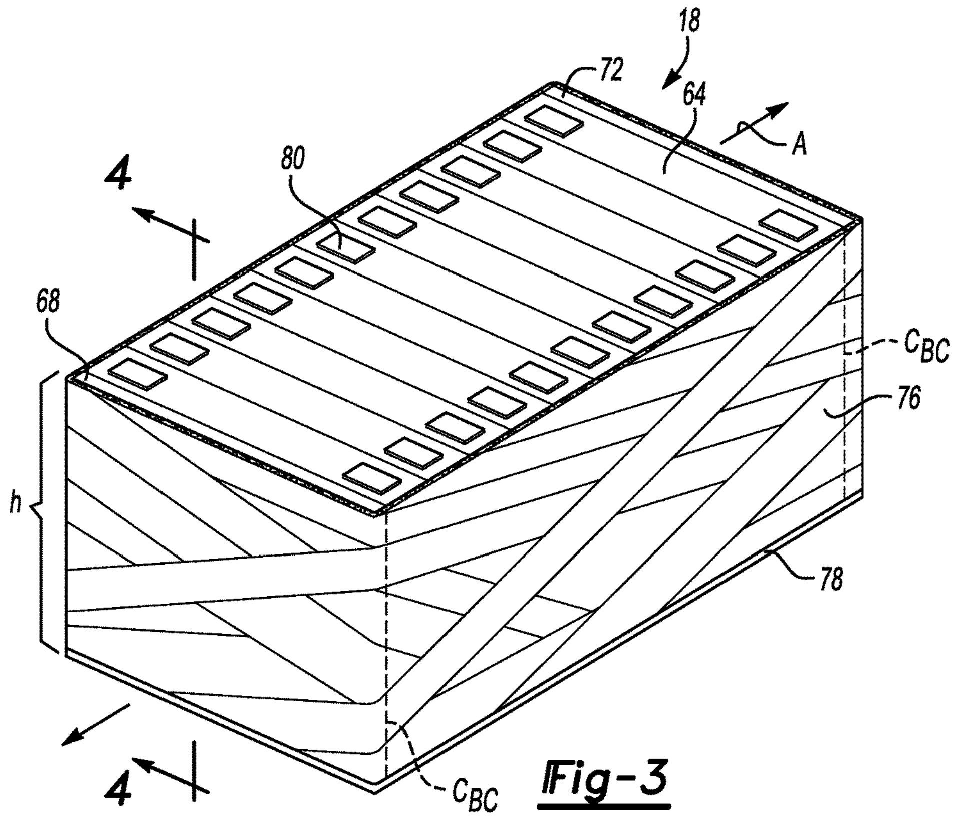


Fig-3

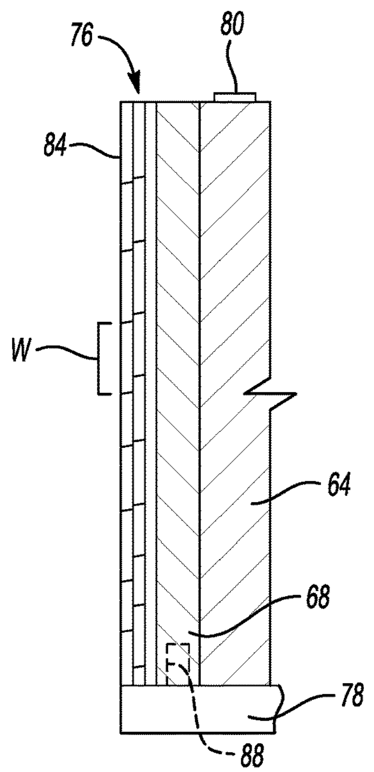


Fig-4

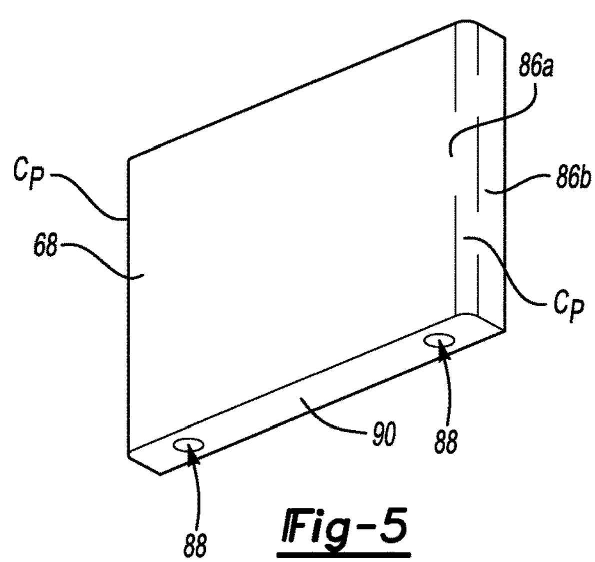


Fig-5

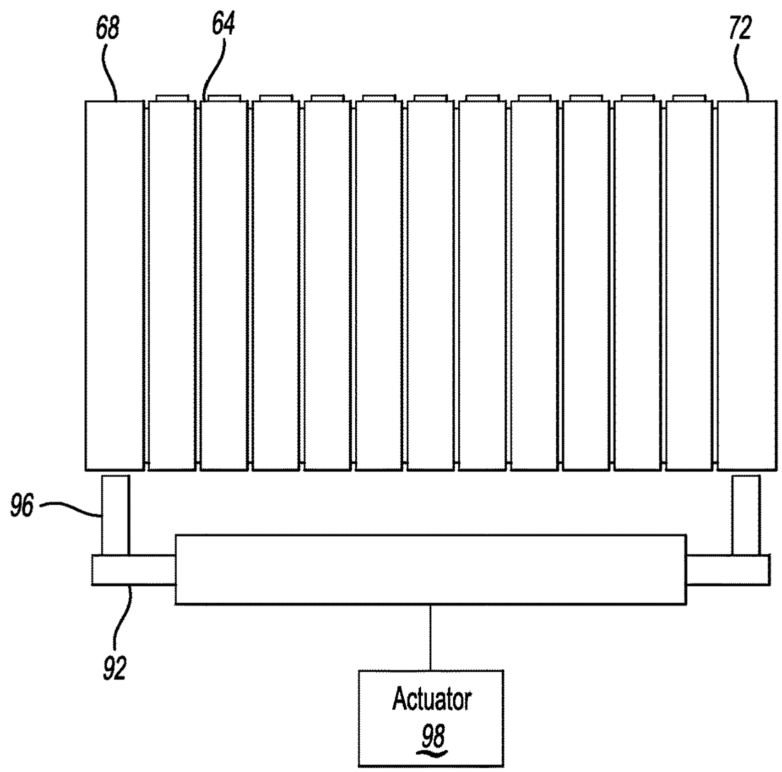


Fig-6

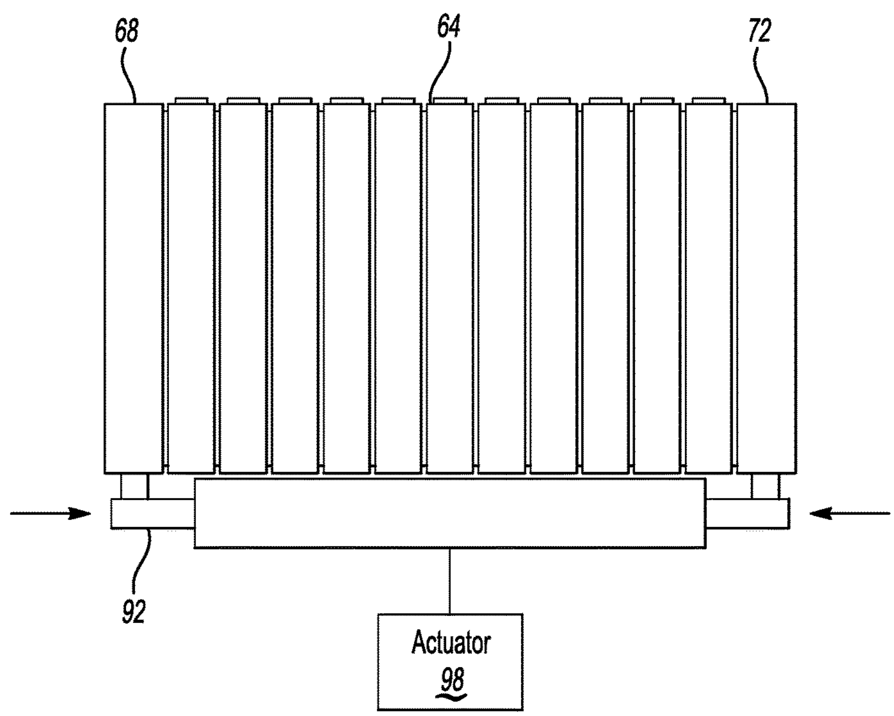


Fig-7

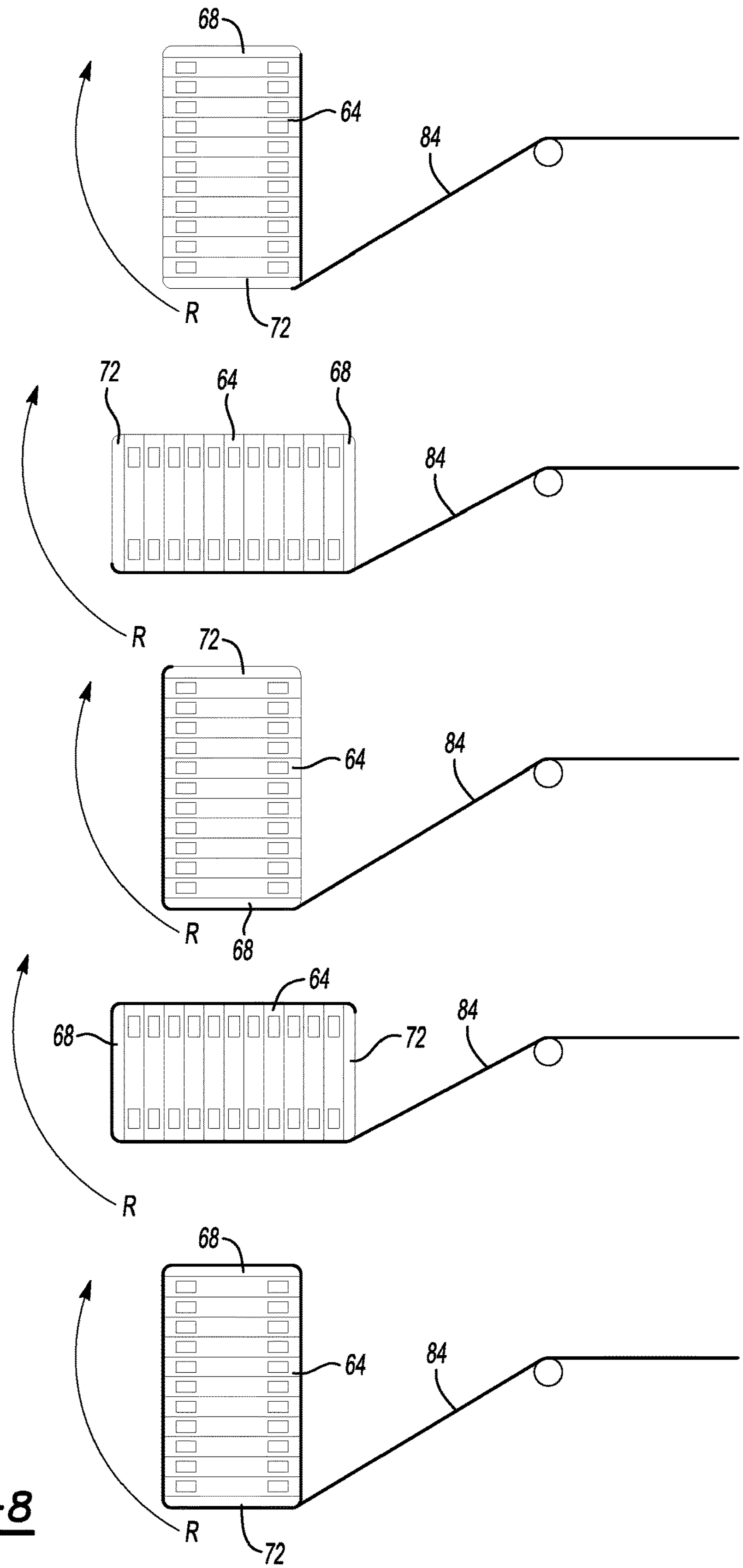


Fig-8

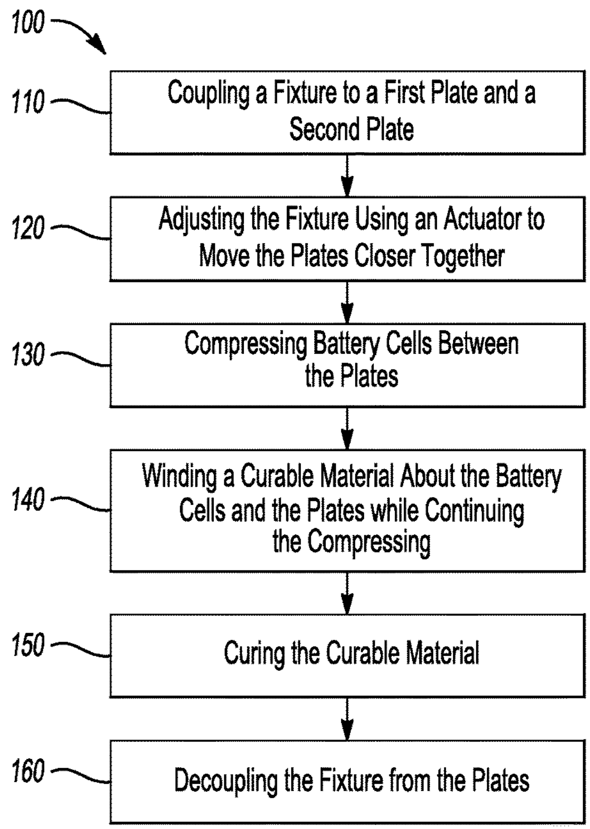

100
110
Coupling a Fixture to a First Plate and a Second Plate
120
Adjusting the Fixture Using an Actuator to Move the Plates Closer Together
130
Compressing Battery Cells Between the Plates
140
Winding a Curable Material About the Battery Cells and the Plates while Continuing the Compressing
150
Curing the Curable Material
160
Decoupling the Fixture from the Plates

Fig-9

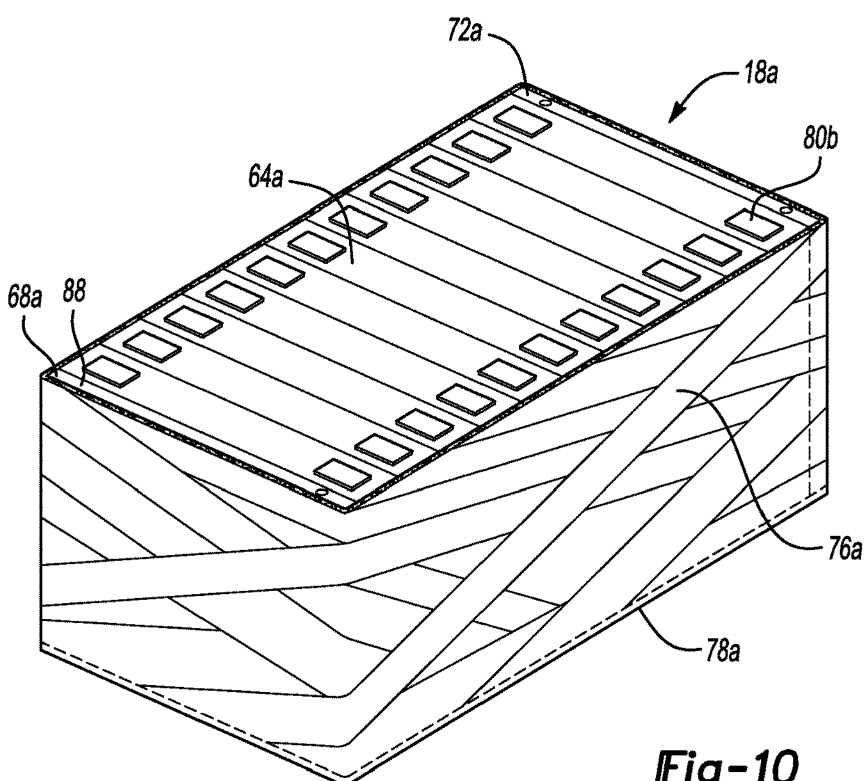
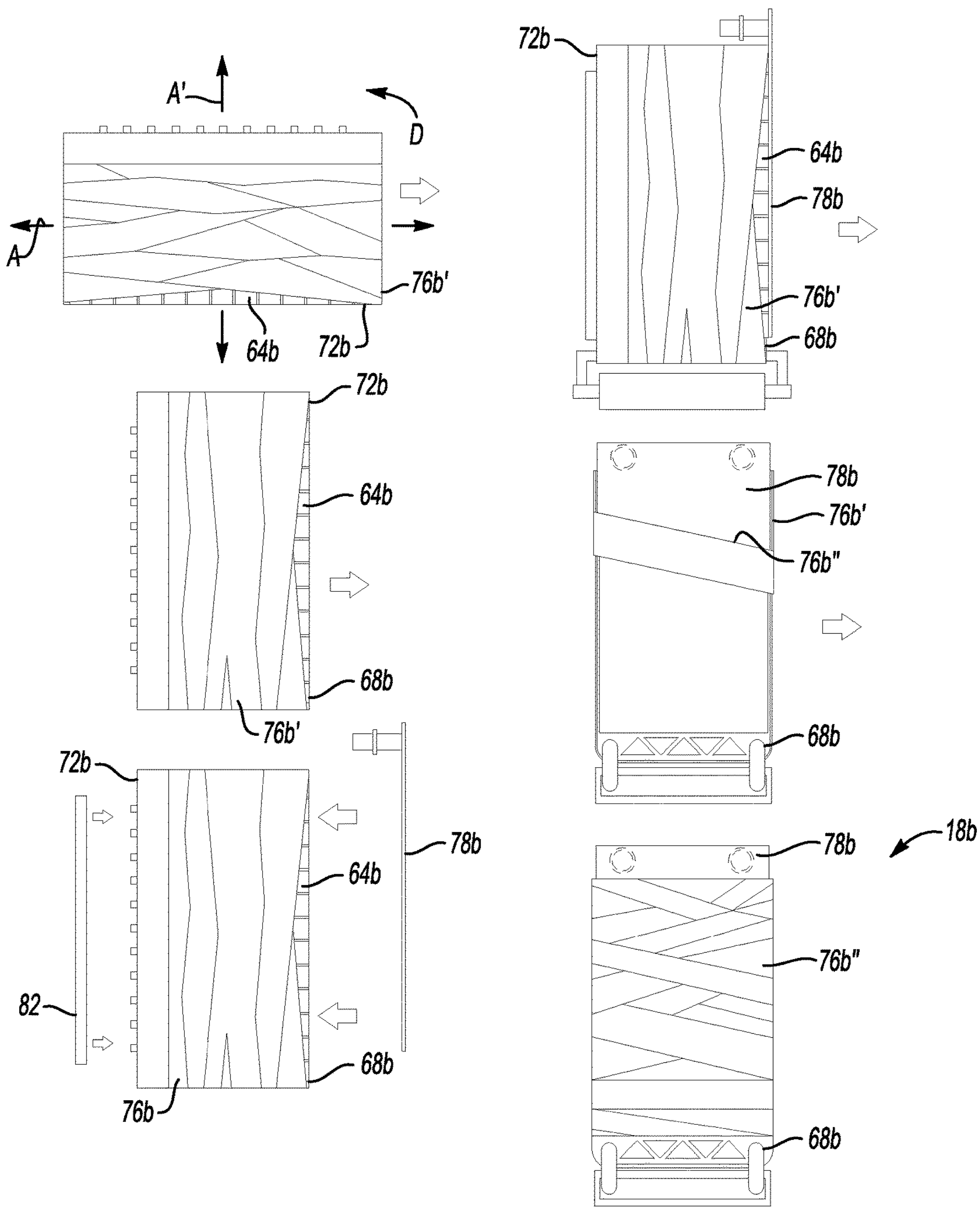

72a
18a
80b
64a
68a
88
76a
78a

Fig-10



A'
D
A
76b'
64b
72b
72b
64b
68b
76b'
72b
78b
64b
82
68b
76b
72b
64b
78b
76b'
68b
78b
76b'
76b"
68b
18b
78b
76b"
68b

Fig-11

BATTERY CELL COMPRESSION METHOD AND ASSEMBLY

TECHNICAL FIELD

This disclosure relates generally to a battery array and, more particularly, to a curable material at least partially wound around battery cells of the battery array.

BACKGROUND

Electrified vehicles differ from conventional motor vehicles because electrified vehicles are selectively driven using one or more electric machines powered by a traction battery pack. The electric machines can drive the electrified vehicles instead of, or in addition to, an internal combustion engine. Example electrified vehicles include hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), fuel cell vehicles (FCVs), and battery electric vehicles (BEVs).

A traction battery pack of an electrified vehicle can include one or more battery arrays. Plates, such as end plates and side plates, are positioned about the battery cells of the arrays. Tensioning rods, or other bracing features, pull opposing plates together to compress the battery cells, which can expand over time. The plates are typically metal.

SUMMARY

A method according to an exemplary aspect of the present disclosure includes, among other things, winding a curable material at least partially about a plurality of battery cells that are compressed by a fixture.

In a further non-limiting embodiment of the foregoing method, the method includes, after the curable material has cured, holding the plurality of battery cells in a compressed position using the curable material rather than the fixture.

A further non-limiting embodiment of any of the foregoing methods includes winding the curable material about an entire circumferential perimeter of the plurality of battery cells.

A further non-limiting embodiment of any of the foregoing methods includes compressing the plurality of battery cells prior to the winding by moving a first plate toward a second plate using the fixture. The plurality of battery cells are positioned between the first and second plates.

In a further non-limiting embodiment of any of the foregoing methods, the fixture is coupled to the first and the second plate when the fixture is compressing the plurality of battery cells, and is decoupled from the first plate and the second plate after the curable material has cured.

In a further non-limiting embodiment of any of the foregoing methods, the fixture is coupled to respective coupling surfaces of the first and the second plate when the fixture is coupled to the first and the second plate, and the winding includes winding the curable material about winding surfaces of the first and second plate. The winding surfaces are transverse to the coupling surfaces.

A further non-limiting embodiment of any of the foregoing methods includes using an actuator to adjust the fixture to a position where the plurality of battery cells are compressed by the fixture, and decoupling the fixture from the actuator while the plurality of battery cells are compressed by the fixture.

In a further non-limiting embodiment of any of the foregoing methods, the curable material is a fiber-reinforced polymer-based tape.

A further non-limiting embodiment of any of the foregoing methods includes winding the curable material at least three times about a perimeter of the plurality of battery cells.

A further non-limiting embodiment of any of the foregoing methods includes winding the curable material about the plurality of battery cells and about a thermal exchange plate such that the curable material holds the thermal exchange plate relative to the plurality of battery cells after the curable material has cured.

In a further non-limiting embodiment of any of the foregoing methods, the plurality of battery cells are part of a traction battery pack.

In a further non-limiting embodiment of any of the foregoing methods, the winding includes rotating the plurality of battery cells relative to the curable material.

In a further non-limiting embodiment of any of the foregoing methods, the curable material is cured after the winding.

In a further non-limiting embodiment of any of the foregoing methods, a first amount of the curable material is wound about the battery cells to compress the battery cells between first and second plates, and a second amount of the curable material is wound about the battery cells to hold a device relative to the battery cells. The first amount of material is wound about a first axis. The second amount of material is wound about a second axis transverse to the first axis.

An assembly according to an exemplary aspect of the present disclosure includes, among other things, a plurality of battery cells compressed by a fixture, and a curable material wound around the plurality of battery cells.

In a further non-limiting embodiment of the foregoing assembly, the assembly includes a first plate and a second plate. The fixture is coupled to the first and second plates to compress the battery cells between the first and second plates.

In a further non-limiting embodiment of any of the foregoing assemblies, the first plate and the second plate are a polymer-based material.

In a further non-limiting embodiment of any of the foregoing assemblies, the curable material is a tape that fiber-reinforced and polymer-based.

In a further non-limiting embodiment of any of the foregoing assemblies, the curable material includes at least one layer of the tape.

In a further non-limiting embodiment of any of the foregoing assemblies, the plurality of battery cells are part of a traction battery pack.

BRIEF DESCRIPTION OF THE FIGURES

The various features and advantages of the disclosed examples will become apparent to those skilled in the art from the detailed description. The figures that accompany the detailed description can be briefly described as follows:

FIG. **1** illustrates a schematic view of an example powertrain of an electrified vehicle.

FIG. **2** illustrates a side view of a traction battery pack from the powertrain of FIG. **1**.

FIG. **3** illustrates a battery array from the traction battery pack of FIG. **2** that incorporates an exemplary compression assembly utilizing a curable material.

FIG. **4** shows a section view at Line **4-4** in FIG. **3**.

FIG. **5** shows a perspective view of a plate from the battery array of FIG. **3**.

FIG. **6** shows plates of the battery array of FIG. **3** decoupled from a fixture.

FIG. **7** shows the plates of FIG. **6** coupled to the fixture.

FIG. **8** shows exemplary steps in the process of winding a curable material about the plates and the battery cells of FIG. **7**.

FIG. **9** shows the flow of an exemplary method for winding a curable material around the battery cells of FIG. **7**.

FIG. **10** shows a battery array incorporating a compression assembly as a curable material according to another exemplary embodiment.

FIG. **11** shows exemplary steps in the process of winding a curable material about the plates and the battery cells according to still another exemplary embodiment.

DETAILED DESCRIPTION

This disclosure relates to winding a curable material around battery cells. The battery cells are compressed as the curable material is wound. The material then cures to hold the battery cells in the compressed position.

Referring to FIG. **1**, a powertrain **10** of a plug-in hybrid electric vehicle (PHEV) includes a traction battery pack **14** having a plurality of battery arrays **18**, an internal combustion engine **20**, a motor **22**, and a generator **24**. The motor **22** and the generator **24** are types of electric machines. The motor **22** and generator **24** may be separate or have the form of a combined motor-generator.

Although depicted as a PHEV, it should be understood that the concepts described herein are not limited to PHEVs and could extend to traction battery packs and battery arrays in any other type of electrified vehicle, including, but not limited to, other hybrid electric vehicles (HEVs), battery electric vehicles (BEVs), fuel cell vehicles, etc.

In this embodiment, the powertrain **10** is a power-split powertrain that employs a first drive system and a second drive system. The first and second drive systems generate torque to drive one or more sets of vehicle drive wheels **28**. The first drive system includes a combination of the engine **20** and the generator **24**. The second drive system includes at least the motor **22**, the generator **24**, and the traction battery pack **14**. The motor **22** and the generator **24** are portions of an electric drive system of the powertrain **10**.

The engine **20** and the generator **24** can be connected through a power transfer unit **30**, such as a planetary gear set. Of course, other types of power transfer units, including other gear sets and transmissions, can be used to connect the engine **20** to the generator **24**. In one non-limiting embodiment, the power transfer unit **30** is a planetary gear set that includes a ring gear **32**, a sun gear **34**, and a carrier assembly **36**.

The generator **24** can be driven by the engine **20** through the power transfer unit **30** to convert kinetic energy to electrical energy. The generator **24** can alternatively function as a motor to convert electrical energy into kinetic energy, thereby outputting torque to a shaft **38** connected to the power transfer unit **30**.

The ring gear **32** of the power transfer unit **30** is connected to a shaft **40**, which is connected to the vehicle drive wheels **28** through a second power transfer unit **44**. The second power transfer unit **44** may include a gear set having a plurality of gears **46**. Other power transfer units could be used in other examples.

The gears **46** transfer torque from the engine **20** to a differential **48** to ultimately provide traction to the vehicle drive wheels **28**. The differential **48** may include a plurality of gears that enable the transfer of torque to the vehicle drive wheels **28**. In this example, the second power transfer unit **44** is mechanically coupled to an axle **50** through the differential **48** to distribute torque to the vehicle drive wheels **28**.

The motor **22** can be selectively employed to drive the vehicle drive wheels **28** by outputting torque to a shaft **54** that is also connected to the second power transfer unit **44**. In this embodiment, the motor **22** and the generator **24** cooperate as part of a regenerative braking system in which both the motor **22** and the generator **24** can be employed as motors to output torque. For example, the motor **22** and the generator **24** can each output electrical power to recharge cells of the traction battery pack **14**.

Referring now to FIGS. **2** and **3** with continuing reference to FIG. **1**, the traction battery pack **14**, in an exemplary non-limiting embodiment, includes an enclosure **60** housing three of the battery arrays **18**. In other examples, the enclosure **60** could house fewer than three battery arrays **18**, or more than three battery arrays **18**.

The battery arrays **18** include a plurality of battery cells **64**, a first plate **68**, a second plate **72**, a compression assembly **76**, and a base **78**. The battery cells **64** are distributed along an axis A. Separators (not shown) could be positioned between axially adjacent battery cells **64** within the battery arrays **18**.

The battery cells **64** are lithium ion cells in this example, which, if unconstrained, can expand over time. Specifically, in this example, the battery cells **64** are prismatic cells. In other examples, the battery cells **64** could be pouch type cells, cylindrical cells, or some other type of battery cell.

The first plate **68** is at a first end of the battery cells **64**. The second plate **72** is at an opposing, second end of the battery cells **64**. The battery cells **64** are compressed axially between the plates **68** and **72**. Expansion of the battery cells **64** is thus constrained at each axial end by the plates **68** and **72**.

The compression assembly **76** holds the first plate **68** and the second plate **72** axially in a position suitable for compressing the battery cells **64**. The compression assembly **76**, the first plate **68**, the second plate **72**, and the battery cells **64** are disposed upon the base **78**.

In an exemplary non-limiting embodiment, the base **78** is a thermal exchange plate that communicates a coolant utilized to cool the battery cells **64**. The base **78**, in this example, is disposed at a vertical bottom of the battery cells **64**. Terminals **80** extend from the battery cells **64** at a vertical top opposite the end of the battery cells **64** interfacing with the base **78**.

Referring now to FIGS. **4-5** with continuing reference to FIG. **3**, the compression assembly **76** is a multilayered structure including multiple layers of a curable material. In this exemplary, non-limiting embodiment, the curable material is a fiber reinforced, polymer-based tape **84**. The exemplary fiber of the tape **84** could comprise glass filaments or fibers, carbon fibers, aramid fibers, etc., which are distributed within a polymer-based material. The fibers are substantially non-conductive in this example.

The curable material of the compression assembly **76** is cured to a desired state after being positioned about battery cells **64**. Some battery cells **64** cannot be stored above certain temperatures, say 60 degrees Celsius. Accordingly, the material of the compression assembly **76** is, in such examples, a material that can cure without requiring its temperature to be elevated to temperatures that could impact the battery cells **64**.

In this example, the compression assembly **76** is formed utilizing approximately three layers of the tape **84** wound around the battery cells **64**. The number of layers of the tape

84 need not be consistent throughout the compression assembly 76. A portion of the tape 84 could overlap two other layers, and another portion of the tape 84 could overlap three layers for example.

The example tape 84 is wound about an entire circumferential perimeter of the battery cells 64 in this example. The example tape 84 is additionally wound about the plates 68, 72. In particular, the tape 84 interfaces with winding surfaces 86*a* and 86*b* of the plates 68, 72. The winding surfaces 86*a* face in the direction of the axis A. The winding surfaces 86*b* face laterally away from the axis A.

Winding the tape 84 about the plates 68, 72 at the axial ends of the battery cells 64 distributes the tensioning load from the tape 84 across the plates 68, 72. This can prevent the tape 84 from compressing the battery cells 64 at the axial ends, particularly across the corners C_{BC} of the battery cells 64.

The plates 68, 72, are a metal or metal alloy. In particular, the plates 68, 72 could be extruded aluminum. In another example, the plates 68, 72 are polymer-based, which can provide some weight savings. Corners C_P (FIG. 5) of the plates 68, 72 can have a radius to facilitate bending the tape 84 about the corners C_P without overly stressing an area of the tape 84.

Although the exemplary compression assembly 76 is wound about the battery cells 64 and the plates 68, 72, other exemplary embodiments could include a compression assembly 76 wound about the battery cells 64, but not the plates 68, 72.

After the winding, the tape 84 is permitted to cure. The tape 84, when cured, provides the compression assembly 76, which holds the axial position of the first plate 68 and the second plate 72, and additionally protects the axial ends and laterally facing sides of the battery array 18. When cured, the tape 84 effectively compresses the battery cells 64 so that no tensioning rods or similar bracing features are required.

The tape 84, in this exemplary non-limiting embodiment, has a width W which is less than a height H of the first plate 68, the second plate 72, and the battery cells 64. The tape 84 is thus wound about the outer periphery of the plates 68, 72, and the battery cells 64 multiple times in order to ensure that layers of the tape 84 extend the full height H of the plates 68, 72, and battery cells 64.

Referring now to FIGS. 6-7, with continuing reference to FIGS. 3-5, the battery cells 64 are compressed axially between the plates 68, 72 as the tape 84 as the tape 84 is applied.

In this example, the plates 68, 72 include a pair of bores 88 opening to a coupling surface 90 of the plates 68, 72. The coupling surface 90 is transverse, and in this example perpendicular, to the winding surfaces 86*a* and 86*b*.

The bores 88 provide an interface to couple the plates 68, 72 to a fixture 92. The fixture 92 is used to compress the battery cells 64 along the axis A between the plates 68, 72 so that the tape 84 can be applied with the battery cells 64 in a desired compressed position.

The fixture 92 includes pins 96 received within the bores 88 to couple the plates 68, 72 to the fixture 92. The fixture 92 is removeably mounted upon an actuator 98. The actuator 98 manipulates the pins 96 between positions that are axially closer to each other, and positions that are axially further from each other.

The actuator 98 could have many forms, including, but not limited to, a hydraulic actuator, a pneumatic actuator, or a rack-and-pinion type configuration.

When the fixture 92 is coupled to the plates 68, 72, and mounted to the actuator, the actuator 98 can manipulate the fixture to a position causing the fixture to draw the plates 68, 72 closer together, which compresses the battery cells 64 axially. The fixture 92 can then be locked in the position compressing the battery cells 64 and disengaged from an actuator 98. The battery cells 64, and the plates 68, 72, are then transitioned to a wrapping stage where the curable material is applied that will cure to form the compression assembly 76 of FIG. 3.

Referring to FIG. 8, the battery cells 64 and the plates 68 are compressed axially by the fixture 92, which has been detached from the actuator 98. The fixture 92 thus keeps the battery cells 64 compressed even when the fixture 92 is detached from the actuator 98.

The battery cells 64 with the plates 68, 72 are rotated in a direction R relative to a roll of the tape 84. The battery cells 64 and plates 68, 72 thus act as a mandrel. In another example, the tape 84 can be rotated relative to the battery cells 64 and the plates 68, 72

The rotation in the direction R causes the tape 84 to wrap about the battery cells 64 and the plates 68 and 72. The wrapping of the tape 84 continues until the compression assembly 76 has a desired thickness. Again, the fixture 92 keeps the battery cells 64 and the plates 68, 72 compressed axially during the wrapping.

Notably, the battery cells 64 with the plates 68 and 72 can be tipped relative to the tape 84 as the tape 84 is applied to cause the tape 84 to adhere to the battery cells 64 and the plates 68, 72 at an angle. That is, when applying, for example, the tape 84 to a side of the battery cells 64, the battery cells 64 can be tipped so that the tape 84 is applied in a way that extends the tape 84 from a vertical bottom at a first axial end of the battery cells 64 to a vertical top at an opposite axial end of the battery cells 64. Angling the tape 84 in this way could help to withstand torsional loading of the battery array 18.

After the tape 84 has wound about the battery cells 64 enough times to provide a desired thickness for the compression assembly 76 of FIG. 3. The compression assembly 76 is permitted time to cure while the fixture 92 continues to compress the battery cells 64 between the plates 68, 72. After curing, the tape can hold the axial position of the plates 68, 72. The fixture 92 can then be decoupled from the plates 68, 72. The battery cells 64 and the compression assembly 76 can then be positioned atop the base 78.

Referring now to FIG. 9, an exemplary method 100 of incorporating a compression assembly into a battery array includes a step 110 of coupling a fixture to a first plate and a second plate. Then, at a step 120, the fixture is adjusted using an actuator to move the plates closer together. At the step 130, battery cells are compressed between the plates that are moving closer together.

Next, at a step 140, a curable material is wound about the battery cells and the plates while the fixture continues to compress the battery cells between the plates. At a step 150, the curable material cures while the fixture continues to compress the battery cells between the plates. Next, at a step 160, the fixture decouples from the plates. At this point, the curable material, which has now cured, can sufficiently hold the battery cells in the compressed position.

Referring now to FIG. 10, another exemplary battery array 18*a* suitable for use within the traction battery pack 14 of FIG. 1 includes a compression assembly 76*a* similar in design to the compression assembly of FIG. 3 in that the compression assembly 76*a* is formed of a curable material. In the compression assembly 76*a*, the curable material has been wound around the base 78*a*, as well as plates 68*a* and 72*a*, and battery cells 64*a*.

The compression assembly **76***a* holds the base **78***a* relative to the battery cells **64***a*, in addition to holding the axial position of the plates **68***a* and **72***a*.

Since the compression assembly **76***a* includes winding about the base **78***a*, a fixture compressing the battery cells **64***a* during the winding can, for example, engage bores **88***a* opening to an upwardly facing surface of the plates **68***a* and **72***a*. Coupling such a fixture to this side of the plate **68***a* and **78***a* can avoid the fixture interfering with the winding of the curable material about the base **78***a*.

In other examples, the curable material of the compression assembly **76***a* could additionally, or instead, be wound about the surfaces of the battery cells **64***a* incorporating the terminals **80***b*. These surfaces are vertically top surfaces in this example. The curable material could be wound in a way that avoids covering the terminals **80***b*. Alternatively, the curable material could be cut away to reveal the terminals **80***b* after the curable material has cured. Covering the vertically top surfaces of the battery cells **64***a* can help to electrically isolate the battery cells **64***a*.

Referring to FIG. **11**, another exemplary battery array **18***b* suitable for use within the traction battery pack **14** of FIG. **1** includes a compression assembly **76***b* similar in design to the compression assembly of FIG. **3** in that the compression assembly **76***b* is formed of a curable material. In the compression assembly **76***b*, the curable material has been wound around the base **78***b*, a busbar assembly **82** or module, as well as plates **68***b*, **72***b*, and battery cells **64***b*.

The compression assembly **76***b* includes a first assembly **76***b*' and a second assembly **76***b*". The first assembly **76***b*' represents a first amount of a curable material, and the second assembly **76***b*" represents a second amount of a curable material.

The first assembly **76***b*' is wound around the plates **68***b*, **72***b*, and battery cells **64***b*. The first assembly **76***b*' is wound about an axis A', which is transverse to the axis A. Again, the battery cells **64***b* are distributed along the axis A. In this example, the axis A' is transverse to the axis A.

The first assembly **76***b*' is then permitted to fully cure or partially cure. A fixture, such as the fixture **92** (FIGS. **6** and **7**) holding the plates **68***b*, **72***b* can then be decoupled.

Next, the plates **68***b* and **72***b*, and the battery cells **64***b* are tipped up in a direction D, and devices, such as the base **78***b* and the busbar assembly **82** are positioned against the battery cells **64***b*. The base **78***b* is a thermal exchange plate, in this example. The base **78***b* includes coolant ports.

The second assembly **76***b*" is then wound around the battery cells **64***b*, the base **78***b*, and the busbar assembly **82**. The second assembly **76***b*" is wound about the axis A, which is perpendicular to the axis A'. The second assembly **76***b*", when cured, holds the devices relative to the battery cells **64***b*.

A fixture **92***b* can engage the plate **68***b* to rotate the battery cells **64***b* about the axis A. The curable material could move about the battery cells **64***b* in another example.

The compression assembly **76***b* holds the base **78***b* relative to the battery cells **64***b*, in addition to holding the axial position of the plates **68***b* and **72***b*.

In some examples, the second assembly **76***b*" is applied when the first assembly **76***b*' is partially cured, which can facilitate bonding the second assembly **76***b*" to the first assembly **76***b*'.

In some examples, the spacing of the second assembly **76***b*" from the battery cells **64***b* can provide a vent chamber used to communicate a fluid from the battery cells **64***b* during a venting event. The busbar assembly **82** can block movement of the second assembly **76***b*" against the battery cells **64***b* to provide the vent chamber, for example.

Features of the disclosed examples include a compression assembly of a curable material. The compression assembly can provide, among other things, sidewalls and endwalls of a battery array. The compression assembly can reduce an overall size of the array since fasteners and tensioning rods and other bracing features are not required.

The plate size can also be reduced since the plates, among other things, do not interface with bracing features like tensioning rods. The plates are subject to the distributed loads of the compression assembly, but not the more focused point loads of such bracing features.

The high tensile strength to weight ratio for the curable material verses, for example, steel, can permit the thickness of the compression assembly to be less than a steel sidewall providing protection and support.

The preceding description is exemplary rather than limiting in nature. Variations and modifications to the disclosed examples may become apparent to those skilled in the art that do not necessarily depart from the essence of this disclosure. Thus, the scope of legal protection given to this disclosure can only be determined by studying the following claims.

What is claimed is:

1. A method, comprising:

winding a curable material at least partially about a plurality of battery cells that are compressed by a fixture.

2. The method of claim **1**, further comprising, after the curable material has cured, holding the plurality of battery cells in a compressed position using the curable material rather than the fixture.

3. The method of claim **1**, further comprising winding the curable material about an entire circumferential perimeter of the plurality of battery cells.

4. The method of claim **1**, further comprising compressing the plurality of battery cells prior to the winding by moving a first plate toward a second plate using the fixture, the plurality of battery cells positioned between the first and second plates.

5. The method of claim **4**, wherein the fixture is coupled to the first and the second plate when the fixture is compressing the plurality of battery cells, and is decoupled from the first plate and the second plate after the curable material has cured.

6. The method of claim **4**, wherein the fixture is coupled to respective coupling surfaces of the first and the second plate when the fixture is coupled to the first and the second plate, and the winding comprises winding the curable material about winding surfaces of the first and second plate, the winding surfaces transverse to the coupling surfaces.

7. The method of claim **1**, further comprising using an actuator to adjust the fixture to a position where the plurality of battery cells are compressed by the fixture, and decoupling the fixture from the actuator while the plurality of battery cells are compressed by the fixture.

8. The method of claim **1**, wherein the curable material is a fiber-reinforced polymer-based tape.

9. The method of claim **1**, wherein the winding comprises winding the curable material at least three times about a perimeter of the plurality of battery cells.

10. The method of claim **1**, wherein the winding comprises winding the curable material about the plurality of battery cells and about a thermal exchange plate such that the curable material holds the thermal exchange plate relative to the plurality of battery cells after the curable material has cured.

11. The method of claim **1**, wherein the plurality of battery cells are part of a traction battery pack.

12. The method of claim **1**, wherein the winding comprising rotating the plurality of battery cells relative to the curable material.

13. The method of claim **1**, wherein the curable material is cured after the winding.

14. The method of claim **1**, wherein a first amount of the curable material is wound about the battery cells to compress the battery cells between first and second plates, and a second amount of the curable material is wound about the battery cells to hold a device relative to the battery cells, the first amount of material wound about a first axis, the second amount of material wound about a second axis transverse to the first axis.

15. An assembly, comprising:

a plurality of battery cells compressed by a fixture; and

a curable material wound around the plurality of battery cells.

16. The assembly of claim **15**, further comprising a first plate and a second plate, the fixture coupled to the first and second plates to compress the plurality of battery cells between the first and second plates.

17. The assembly of claim **16**, wherein the first plate and the second plate are a polymer-based material.

18. The assembly of claim **15**, wherein the plurality of battery cells are part of a traction battery pack.

19. An assembly, comprising:

a plurality of battery cells compressed by a fixture; and

a curable material wound around the plurality of battery cells, the curable material is a tape that is fiber-reinforced and polymer-based.

20. The assembly of claim **19**, wherein the curable material comprises at least one layer of the tape.

* * * * *